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SULPHURIC ACID TREATMENT FOR BLACK LOCUST SEED

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* - This series of publications releases data gathered in connection with investigations being carried on at the Southern Station. The information contained in them is subject to correction or amplification following further investigation. - Editor

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Viable black locust seeds often germinate slowly and incompletely owing to the fact that the seed coats are hard and do not readily absorb water. Hot water treatment, often recommended for softening seed coats, is frequently impractical with black locust seed because it leaves the seed softened and swollen, makes planting and handling more difficult, and necessitates immediate sowing. Moreover, some seed is but relatively little effected by such treatment.

Numerous tests have now demonstrated that soaking black locust seed in sulphuric acid is a very effective and practicable means of increasing germination and seedling yield. If done properly, seed treated in this manner remains hard and unswollen and may be dried out thoroughly before sowing without lowering viability. This permits storage after treatment and the use of mechanical sowing devices.

Briefly, the treatment consists of:

1. Soaking the seed in concentrated sulphuric acid for the required period (usually 45 minutes to one hour).

2. Draining off the acid.

3. Washing the seed in cool running water.

4. Spreading the seed out to dry.

All that is needed is a supply of acid, running water, stoneware or other acid-resistant containers in which to treat the seed, and a sieve box or wire basket in which the seed can be washed.

Treatment of seed in 1- to 10-pound lots is a relatively simple matter. The seed is placed in a stone jar or porcelain enameled bucket, covered with acid, and gently stirred with a stick until all seeds are thoroughly coated. After soaking, the seeds are restirred slightly to separate them and are then poured into a screen-wire

[1] The instructions issued in a mimeographed leaflet "New Sulphuric Acid Treatment for Stimulating Germination of Black Locust Seed" dated May 9, 1934, have been revised in the light of later studies and experience. The Station has received many inquiries regarding the treatment and, pending publication of the details in a forthcoming Departmental Circular, these additional instructions are being made available. This statement includes and supplements information contained in the earlier leaflet.

basket to drain with another container placed beneath to catch the acid. After a few minutes, or when all of the free acid has drained off, the seeds are placed under a stream of cool water and washed thoroughly for from 5 to 10 minutes, after which they are spread out to dry.

When large quantities of seed are to be treated, a more efficient method is to place the seed in a wire basket and lower this into another vessel containing the acid. This arrangement prevents undue handling of the acid and seed. After the required immersion period has elapsed, the seed container is hoisted and the acid allowed to drain back directly into the acid container after which the seed can be dumped into a sieve box and washed. A large stoneware crock or an ordinary steel oil drum, thoroughly cleaned, will serve as a suitable container for acid. A seed container, either circular or square in cross section, can be easily fashioned out of 16-mesh galvanized wire screen, using several thicknesses and reinforcing the screen on the outside with 1-inch mesh poultry netting. A suitable sieve box can be made by replacing the bottom of an ordinary wood-packing box with similar screen materials. These will withstand many treatments although in time they will, of course, be affected by the acid.

In comparative tests, impure concentrated acid (specific gravity 1.84) of the technical or commercial type has proved almost as effective as pure acid and its use is recommended because of the lower cost. Ordinarily technical acid can be purchased for about seven cents per pound or less. Roughly, a pound of acid is required to cover fully each pound of seed, but the acid can be recovered and re-used a number of times. It becomes thickened and darkened with use and gradually loses its effectiveness, but the addition of fresh acid from time to time to replace that not recovered will maintain the chemical at the proper strength and consistency.

The treatment of very large quantites of seed in one operation, using the above mentioned equipment, is not recommended. Not only is less acid recovered but large quantities of seed are difficult to handle and empty into the sieve box; the seeds tend to adhere to each other and when in large masses have to be stirred vigorously before they can be removed from the container. About 50 pounds is a convenient quantity to treat at one time.

Different lots of seed vary considerably in the length of treatment required for optimum results. Immersion in the acid for from 45 to 60 minutes appears to be the optimum period for most lots of seed, although treatment for two full hours has given best results with a few lots. For certain lots of specially permeable seed a 30-minute period may be ample. In the absence of specific tests, a 45- to 60-minute treating period is recommended. Since about 15 minutes is required for the acid to drain fully from a 50-pound lot of seed after it is removed from the acid, this time should be considered as part of the treating period; i.e., a 60-minute treatment should consist of a 45-minute immersion period and a 15-minute draining period.

If treatment of any considerable quantity of seed is comtemplated, it is recommended that the optimum period of treatment for the particular lot or lots of seeds involved be established by a few preliminary tests. Samples of seed should be treated with acid for 30, 45, 60, and 90 minutes after which at least four random samples of 100 seeds each should be taken from each treatment and sown in sand flats or in the nursery to get a comparable germination test. If time does not permit of sowing tests, inspection of treated seed will reveal whether a given treatment has been too drastic. Properly treated seed should show few, if any, corroded seed coats and, except in the

case of the light, mechanically injured, or otherwise imperfect specimens, they should be in a hard, sound condition after treatment and subsequent drying.

Seed should be treated during cool weather and preferably when air temperatures do not exceed 70° F. This is very important, as higher temperatures increase the effect of the acid. If it is necessary to treat seed when temperatures are from 75° to 95°, the period of treatment should be reduced about 25 to 50 percent in order to compensate for the increased effectiveness of the acid. Treatment is not recommended at times when air temperatures exceed 95°. Furthermore, acid and equipment should conform in temperature and should not be left exposed to the hot sun or other source of heat prior to use. The treatment itself should be carried on in a cool, shaded place.

Additional precautions should be observed in washing seed after immersion in acid, particularly when as much as 50 pounds is being treated at one time. As a matter of economy all free acid should be drained from the seed before it is dumped in the sieve box to be washed, and this is also important as a precautionary measure in preventing excessive heating of the seed. The water should be cool and should be applied in ample quantities to counteract the heating effect produced by mixing water with the acid. It is advisable to have several large pails of water at hand and to douse these in rapid succession over the seed, then follow with routine washing under a stream of water. The water should not be applied under too strong pressure. The seed should be washed for a period of five to fifteen minutes, depending on the quantity of seed being treated. Longer washing periods are not required to rinse off the acid and may cause some injury to the seed.

Immediately after washing, the seed should be spread out in a thin layer on a tarpaulin or shed floor located in a cool, shaded place to dry. When thoroughly dry, the seed can be sacked and stored.

The acid treatment described here has proved very effective and in extensive field tests carried on at Holly Springs, Miss. in 1934, approximately doubled the yield of black locust seedlings. When carried on as outlined the treatment has proved safe. Out of hundreds of trials carried on by the writer in which various lots of seed were immersed in the acid for periods ranging from 30 minutes up to two hours, only a few treatments were injurious to the seed and these were directly attributable to high temperature. Practicability of the method has been demonstrated in large-scale treatments carried on by the Mississippi Forest Service in northern Mississippi in connection with the growing of seedlings for gully control planting projects. Approximately two tons of black locust seed were treated in 1934 and four tons during the current (1935) season.

No special hazards are involved in handling the acid, and burns or injuries to workmen are entirely preventable if reasonable care is exercised. Old clothing and leather gloves should be worn as a special precaution, and soap or a weak alkali solution should be at hand to treat accidental burns should they occur.

The costs of the treatment are variable and depend on the quantity of seed treated at one time, the quantity of acid recovered, and the number of times it is reused. Treating an entire lot of seed at a single operation would result in relatively high costs for acid and equipment. As previously pointed out, treatment of seed in small lots is more economical of acid and permits more effective treatment. From 80 to 95 percent of the acid can be recovered after each treatment, and it may be re-

used 10 or 12 times. When 50-pound lots of seed are treated at one time a maximum of 10 pounds of acid will be lost in the process. In large-scale treatments carried on during the 1934 season, costs came to about four to five cents per pound of seed treated with acid costing seven cents per pound and labor 40 cents per man-hour. Undoubtedly these costs can be reduced. More suitable equipment can perhaps be devised to reduce handling costs and to permit treatment of larger quantities of seed at one time. For example, it may prove more feasible to carry out the entire treatment in one large vat or hopper equipped with a special outlet through which the acid, rinse water, and seed can be removed in successive operations.